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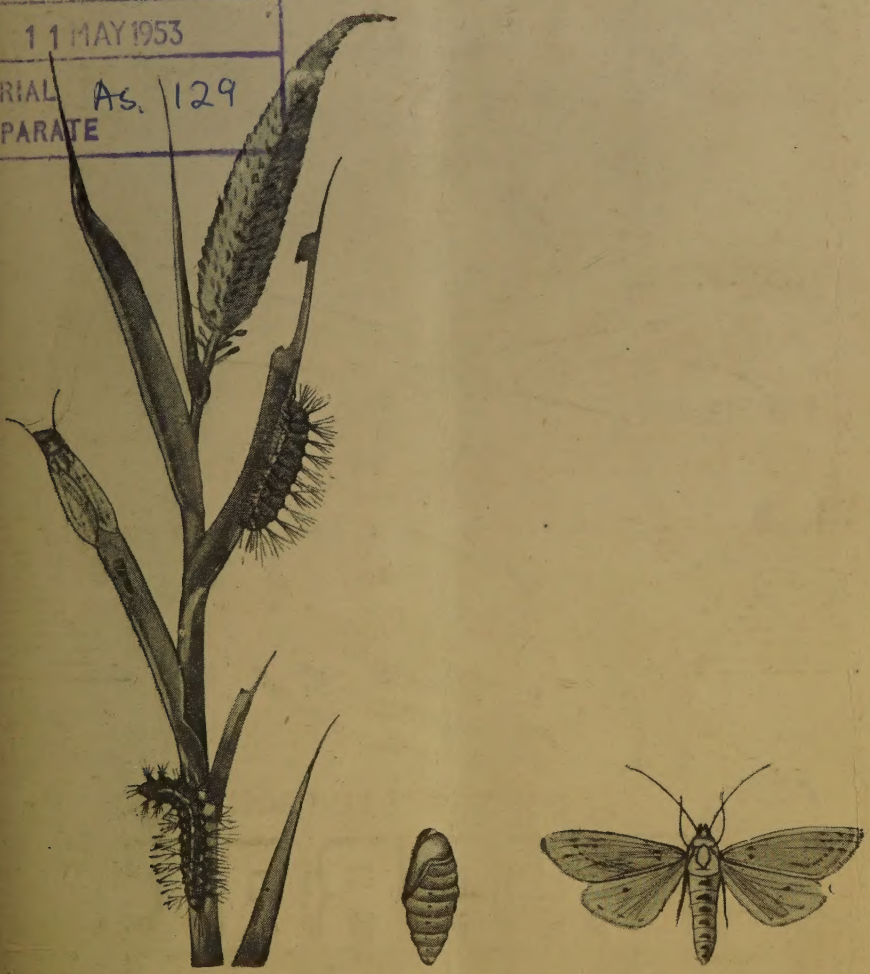
DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE

MINISTRY OF FOOD AND AGRICULTURE, GOVERNMENT OF INDIA

# PLANT PROTECTION BULLETIN

"SCIENCE IN PRACTICE"





Kutra (*Agrotis albistriga* Walker)

ISSUED BY THE PLANT PROTECTION ADVISER TO THE GOVERNMENT OF INDIA, NEW DELHI

*Price* : *Rs.* 1|-|- *or* 1*sh* 6*d.*

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## PLANT PROTECTION WORK IN HYDERABAD STATE DURING 1951-52.*

To guide and help the farmer, the Department of Agriculture in Hyderabad State has organised a plant protection service with modest staff equipped with necessary chemicals and machinery. Their duties are primarily to demonstrate and to educate the cultivators in the proper methods of control.

The important items of work under operation are for the large scale control of (i) Paddy Hispa (ii) Paddy Gallfly (iii) Deccan Wingless grasshopper, and (iv) Smut of Jowar, all of which cause considerable damage to crops. Some work is also undertaken to control pests and diseases attacking fruit trees and vegetables, and other economic crops like chillies and groundnut.

Adequate quantities of the requisite insecticides and fungicides are stocked in important centres and trained staff are posted at those places with enough equipment of dusters, sprayers, etc. The plant protection service is free and only the cost of labour and chemicals is recovered from the cultivators.

**Control of Insect pests :**

The Hispa causes severe damage to the paddy crop both in the nursery and in the field and spreads rapidly. Over seven thousand (7,000) acres of this crop was protected from this insect in the districts of Nizamabad, Medak, Hyderabad, Mahbubnagar, Warangal and Karimnagar. The Army Worm, a pest that eats away the crop overnight, was also controlled in the above districts wherever reported. The Paddy Gallfly another serious pest on paddy was controlled by means of light traps over an area of 2,000 acres in the Mahbubabad taluqa of Warangal district.

Large scale outbreak of the Wingless Grasshopper on Jowar was controlled in time in Gadwal over an area of 500 acres.

Five hundred acres of groundnut were treated against Aphis in the districts of Osmanabad, Raichur, Mahbubnagar and Hyderabad. Thrips on Chillies were controlled over 500 acres in Warangal district. In addition to this, valuable vegetables in the kitchen gardens of Hyderabad were protected against various pests and diseases.

The castor crop—over an area of 1,000 acres—particularly in the districts of Mahbubnagar and Nalgonda, was saved from complete devastation by the Castor Semi-looper.

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*An extract from a press note issued by the Deptt. of Agriculture, Hyderabad Deccan and a note received from the Plant Pathologist, Government of Hyderabad.

The estimated net saving in crops due to protection measures adopted is : Paddy 16,500 maunds ; Castor 5,000 maunds ; Chillies 3,125 maunds and Groundnuts 750 maunds besides Jowar and others not included in the estimation.

**Control of Plant Diseases :**

Grain Smut, the most important disease of Jowar was effectively controlled by presowing-treatment of seed with Sulphur. Jowar seed sufficient to cover about 11,64,448 acres was treated with 16.6 tons of Sulphur. An estimated gain of 8,23,336 maunds of Jowar was obtained. Paddy seed sufficient to cover about 1,000 acres was treated with Agrosan GN for the control of seed-borne diseases, and about 100 acres of paddy crop were sprayed with 0.35% Perenox and 1% Bordeaux mixture for the control of Paddy Blast.

Over 4,000 mango trees were dusted and sprayed for the control of Mango, ' Powdery mildew ' and hoppers. About 1,000 citrus trees were sprayed with zinc sulphate and lime mixture for the control of ' French ing ' disease. About 4650 citrus trees were treated for ' Die Back ', ' Gummosis ', ' Chlorosis ' and ' Canker '. About 70 Grape vines were treated for Anthracnose and Powdery mildew diseases. Striga over an area of 64 acres was controlled by Fernoxone spraying and rogueing.

Nearly 600 acres of potato crop was treated with Perenox and Bordeaux mixture for the control of Early Blight of Potato. Chilli ' Powdery mildew ' covering over 11 acres was controlled by dusting with sulphur.

Other diseases such as Sugarcane ' Smut ', Cotton ' red leaf-Blight ', Turmeric ' leaf spot ', Wheat ' stem rust ', etc. were also treated.

## INSECT PESTS OF VINDHYA PRADESH

A survey of insect pests of Vindhya Pradesh was made in the latter half of February, 1951, by an officer of this Directorate. This State is divided into two Divisions (i) The Eastern or the Baghelkhund Division comprising of Rewa, Sadna, Sidhi and Sahdol districts ; and (ii) The Western or the Bundhelkhund Division which comprises of Panna, Chhattarpur, Tikamgarh and Datia districts. The State has a total area of 1,43,55,926 acres (22431 sq. miles), 65% of which is culturable. The cultivated area is however, only 40,62,189 acres, i.e. a little less than 50% of the culturable land. The rainfall varies from 23″ in Datia to 61″ in Sidhi. Generally, it is high in the Eastern districts and low in the Western districts. The crops are mostly rainfed and only a negligible percentage of 0.4% of the cultivated area is irrigated by means of tanks and wells. Owing to mountainous nature of the State, soil greatly varies in texture and may be gravelly, alluvial or clayey of black type. About 60% of the area is put under summer (Kharif) crops and 40% under the winter (rabi) crops. In summer, the most important crops in order of their importance are paddy, kedo (inferior millet), juar, sesamum, other millets, pigeon pea, black gram (urid), maize and bajra, etc. whereas in winter the important crops grown are wheat, gram, barley, linseed, lentil, oil-seeds and peas, etc. Many of the important fruits and vegetables can be successfully raised. Thus, the State promises potential possibilities of intensive agriculture in diversified forms, which the Department of Agriculture is aiming at.

**Pests of Rabi Crops :**

The following pests were observed :

**Wheat :** The area under wheat is 7,37,843 acres and is the major crop of Baghelkhund Division. It is damaged by white-ants, *Microtermes* sp. and the wheat louse, *Macrosiphum granarium.*

**Gram :** This is grown over an area of 5,43,528 acres and is the next important crop of rabi season. It is subject to the attack of cutworms, *Euxoa segetum,* the gram pod borer, *Heliothis armigera,* the beet army-worm, *Laphygma exigua,* and the semilooper, *Plusia* sp. All the above are important pests but the damage from the cut-worms is pronounced in years of early rainfall in winter whereas that from the pod borer is extensive only in years of good precipitation in February.

**Barley :** This is grown over an area of 3,68,729 acres and the only important pest that infests the crop is the corn aphid, *Aphis maidis.*

**Oil Seeds :** Rape and mustard are sown in an area of about 14,936 acres and the important pest so far recorded is the mustard aphis *Rhopalosiphum pseudobrassicae.*

**Pea :** Both the local matari and dwarf peas are grown over an area of about 37,797 acres and are regularly infested with the bean aphis locally termed as Mahu, *Aphis laburni.* The damage by the Lycaenid butterfly, *Polymmatus boeticus* was also suspected in the pods of this crop.

**Tobacco :** The tobacco is sown over a limited area of 2,265 acres near about the dwelling huts for domestic consumption. It is usually found infested with the green aphis, *Myzus persicae* and the capsid bug, *Gallobelicus crassicornis.*

**Pests of Kharif Crops :**

**Paddy :** This is the most important crop of the State and is grown over an area of about 10,79,259 acres. The chief pests of paddy are, the paddy grasshopper, (*Hieroglyphus banian*), the damage from which is alarming, the caseworm (*Nymphula depunctalis*), the swarming caterpillar (*Spodoptera mauritia*), the hispa, (*Hispa armigera*), the gundi bug, (*Leptocorisa sp.*) and the borer, (*Schoenobius incertellus*).

**Maize, juar and bajra :** These crops are grown over an area of 4,01,557 acres and the major pest to which these crops are susceptible, is the maize borer, *Chilo zonellus.*

**Sesamum :** The sesamum crop grown over an area of 2,60,663 acres is stated to be attacked by the gallfly, *Asphondylia sesami.*

**Pigeon pea :** The pigeon pea is grown over an area of about 1,67,230 acres and is damaged on a minor scale by the plume moth, *Exelastis atomosa* the bean aphis, *A. laburni,* the pod fly, *Agromyza* sp., phytophagic chalcid and thrips.

**Green gram (Urid) :** The area under green gram is 1,00,532 acres and is stated to be greatly damaged by the hairy caterpillars locally known as *Katra, Amsacta* sp. during rainy season.

**Cotton & sannhemp :** These are ranked as minor crops. The area under them is about 10,473 acres. According to Shri Phadke, the Deputy Director of Agriculture, Vindhya Pradesh, the cultivation of cotton had received a great set back owing to the severe damage caused by the bollworms. The red cotton bug, *Dysdercus cingulatus* is also found in the State on Malvaceous crops.

**Sugarcane :** The sugarcane is grown over a small area of 5,519 acres at present but the cultivators seem to have a tendency to increase the area under this crop. Its pests are the cane mealy wing, *Aleurolobus barodensis,* the leaf hopper, *Pyrillo* spp., the top borer, *Scirpophaga nivello* and the stem borer, *Sesamia* sp. The last is likely to be an important pest of maize, jowar and bajra also.

**Pests of vegetables :**

The vegetables are grown over a small area of about 7,000 acres only owing to lack of adequate water supply. The potato is damaged by the cutworms, *Euxoa segetis,* the green aphis, *Myzus persicae* and the jassids, *Empoasca devastans.* Cucurbits are damaged by the red pumpkin beetle,

*Aulacophora foveicollis*, the melon fly, *Dacus cucurbitae*, the cotton aphis, *Aphis gossypii* and the capsid bug, *Gallobelicus crassicornis*. Amongst the cruciferous vegetables the cabbage suffers severely from the damage of the diamond back moth, *Plutella maculipennis* and is infested with a green aphid (unidentified) and the cabbage butterfly, *Pieris brassicae*. Turnip and radish bear a severe infestation of the mustard aphis, *Ithopalosiphum pseudobrassicae* and the flea beetles, *Phyllotreta cruciferae*. The ripe tomatoes are damaged by *Lygaeus pandurus* and *L. hospes*. The brinjal is greatly damaged by the jassids, *Empoasca devastans* and fruit borer, *Leucinodes orbonalis*.

Other pests like *Aphis gossypii*, *Epilachna* beetles, *Attractomorpha crenulata* and *Chrotogonus* sp. cause a minor damage. The stem borer, *Euzophera perticellais* is reported to damage the ratoon crop of brinjal that follows a winter of frost. Fenugreek (methi) is infested with *Aphis laburni* in a minor form. The senji (*Melilotus parviflora*) grown for fodder is heavily damaged by *Myllocerus* sp. and *Hypera medicaginis*. The vegetables are also damaged by the crickets such as *Tridactylus* sp. and the black headed cricket, *Gryllulus domesticus*.

**Pests of fruit trees :**

The exact area under the fruit trees, is not known. However, the important fruit trees of the State are mango, citrus, guava, ber, jaman and banana.

The most important pests of mango, viz. the mango hoppers, *Idiocerus* sp. and the Giant mealy bugs, *Drosicha mangiferae* are so far absent from the State. Other pests found in a minor form are : the red ant, *Oecophylla smaragdina*, *Pseudococcus* sp. *Lepidosaphes* sp., *Luciola* sp., *Rhynchophorous* sp. and *Eugnamtus marginalis* on the foliage, *Indarbela* sp. on the bark and *Dacus* sp. in the fruit. Citrus is attacked by citrus psylla (*Diaphorina citri*) and the leaf miner (*Phyllocnistis citrella*) severely and lemon butterfly (*Papilio demoleus*), bark caterpillar (*Indarbela* sp.) blackfly (*Aleurocanthus husaini*) and *Aphis* sp. in a minor form. Guava is mostly free from the infestation of pests except species of Aonidiella and *Vinsonia* scales collected in a minor form at Panna. The most important pest on *ber* is the fruit fly, *Carpomyia vesuviana* which takes a heavy toll of *ber* fruit every year. Other minor pests of ber are jassids, *Empoasca* sp., white-fly *Aleurocanthus* sp. Diaspid scales, *Aonidiella* sp. and *Epipyrops* on the foliage. Commonly found on jaman leaves are leaf sewers and whitefly, *Trialeurodes bicolor* and occasionally *Parlatoria* scales.

**Stored grain pests :**

The most common pests of stored grains in the State are Pai, or Sundi, *Sitopsilus oryza* in wheat, juar, maize and rice ; Tillula *Rhizopertha dominica* and *Tribolium castaneum* in wheat and Bruchids in gram, peas green gram and black gram.

**Predators and parasites ;**

Amongst the Coccinellids the common predators are *Coccinella septumpunctata* that feeds on mustard aphis, wheat louse, green aphis and citrus psylla ; *Chilomenes sexmaculata* on brinjal aphis and green aphis on potato and tobacco ; *Brumus suturalis* on barley aphis and *Scymnus* spp. on green aphis and pea aphids. *Syrphus* larvae are also found on various species of aphids. Other predators recorded are *Chrysopa* sp. and *Liaus* sp. in potato fields. Chalcid parasites are found parasitising *Bruchids* in pulse stores.

Amongst the other useful insects mention may be made of lac culture which is practised on a fairly good scale on *Palas* trees in the State.

**Plant Parasites :**

Cuscuta on ber plantations and Orobanche in tomato and potato fields also call for attention for their eradication in the plant protection set up.

**Rodents and wild life :**

Rats cause havoc and require to be dealt with at an early date. A great damage also caused by monkeys, *langurs,* wild pigs, jackals, hares and birds. No census of wild animals has been taken. But they are present in good numbers on account of ideal conditions afforded by the aforesaid topographic conditions of the place. To reduce enormous losses to food crops, it is essential that immediate steps are taken by the Plant Protection organisation to control these pests. Undoubtedly more caution will be necessary to deal with a delicate problem of killing monkeys and langurs. Some authorities of the State are of the opinion that though religious sentiment is against killing them, it will gradually die out in view of the present food shortage. What calls for immediate attention is, to check the menace of stray cattle which destroy crops on the roadside or in vicinity of dwellings and greatly dishearten many amateur growers of fruit or shade trees.

## SOME IMPORTANT CONCLUSIONS AND RECOMMENDATIONS OF THE SECOND CONFERENCE OF CENTRAL AND STATE PLANT PROTECTION OFFICERS HELD AT NEW DELHI ON THE 16th APRIL, 1952.

1. The Conference noted the progress of plant protection work in the States as explained by their respective representatives and recommended that in view of the obvious and clear possibilities of substantially minimising losses caused by pests, diseases and weeds to food and other valuable crops such as cotton and jute, plant protection work in all States should be intensified and extended to other serious pests and diseases and over much larger areas so as to step up agricultural production very appreciably. For this purpose, the States should immediately take steps for carrying out plant protection work during the next four years against their major pests, including wild animals, diseases and weeds. The Plant Protection Adviser to the Government of India may be supplied copies of the schemes as soon as possible indicating the actual pests, the target of acreage, number of trees, extra staff, quantities of equipment, etc.

2. The problem of the storage of various kinds of agricultural products in a sound condition is an important aspect of plant protection work. The Conference was aware of the efforts made by the Central and State Civil Supplies Departments in regard to the storage of Government stocks of food grains, but considered that the improvement of the storage conditions in the rural areas and the adoption of measures to prevent or disinfest pest infestations not only in cereal grains meant for consumption as well as for seed purposes but also in other commodities such as, groundnuts, cotton seed, potato and other vegetable seeds, constituted basic and permanent problems for plant protection organizations. The Conference, therefore, recommended that this aspect of plant protection work should also receive adequate attention both at the Centre and in the States.

3. The Conference discussed in some detail the present set up and scope of the State Plant Protection Organisations. It was unanimously agreed that the scope of plant protection should be the control of all pests, including rodents and other wild animals, diseases, plant parasites and weeds, injurious to agriculture.

It recommended that :

(a) Plant Protection Organisations in the States should be under one unified control, both technically and administratively, preferably under Entomologists because the work is far more entomological than mycological.

(b) Further, even the field plant protection staff should work under the State Plant Protection Organisation rather than under regional agricultural officers, e.g. Deputy or Assistant Directors of Agriculture. This should be so, firstly because of the specialised nature of plant protection work ; secondly, to provide for co-ordinated and uniform action over areas embracing many districts ; thirdly to ensure mobility and

movement of staff and equipment from one area to another and lastly to provide for the collection of a large variety of technical information as a result of day-to-day field work. The Conference, however, was of the view that in some cases, it may be necessary for some State Plant Protection Officers to delegate some of their administrative functions to other agricultural officers, provided they retained residual administrative powers to achieve the necessary objectives defined above.

(c) Plant Protection Organisations must work in the closest collaboration with agricultural extension workers on the one hand and the Research Organisations for Entomology and Plant Pathology on the other where they are separate, so that the latter may have a correct appreciation of the problems and difficulties experienced in field work with regard to the evolving of suitable methods of control and their application.

(d) The Conference recommended that Entomologists, Plant Pathologists, Plant Protection Officers and others should exercise the greatest caution and restraint in giving certificates to commercial firms about the purity or performance of pesticides but should publish their results in the Plant Protection Bulletin or other suitable scientific journals.

4. The Conference was informed that most of the States had the "Destructive Insects & Pests Act". It recommended that such Acts should be enacted in all other States also so that in cases of emergency, suitable Rules or Notifications may be issued without delay to speed or smoothen plant protection work.

5. The Conference discussed the question of the training of plant protection personnel for work in the different States. It unanimously accepted the view that such training should best be given in the States themselves by their respective Plant Protection Organisations, wherever possible. In the States, which are yet not fully equipped for giving suitable training, arrangements should be made for the purpose by the Central Directorate of Plant Protection, Quarantine & Storage. In addition, the Directorate should organise short duration 'Regional Courses' in collaboration with the local Plant Protection Organisations.

6. (a) The Conference discussed also the question of realising, in part or full, the cost of control operations against pests and diseases from the cultivators. It considered that for at least the first three years control operations against pests and diseases should be regarded as demonstrations (extension) and as such, should be free of charge. As these demonstrations should be adequate to convince the cultivators of the efficacy of measures advocated, the latter should be increasingly made to pay for the costs of the pesticides, hire of machines and labour.

(b) The Conference noted that in many States the Plant Protection staff are not only temporary but their posts under them are sanctioned from year to year. The Plant Protection Organisations everywhere should be on a permanent footing, since pests and diseases are perennial enemies of agriculture in India as in other countries.

## CONTROL OF FRUIT-FLIES.*

**Control Measures :**

The accent on control must be placed on prevention rather than cure—attack at the source being the best strategy for fruit-fly control. It is important to commence control measures before infestation is actually observed. Attempts to save any particular variety when already severely infested cannot be expected to succeed, but control measures must be continued to prevent spread of infestation to later-ripening varieties. It is exceedingly difficult to stem an influx of fruit flies from a heavily infested orchard, and economic control in later varieties can best be obtained by complete control in earlier varieties.

**Poison-bait sprays.**—Poison-bait spraying is the most effective known method of fruit-fly control. Certain experiments with new methods of approach to the problem, such as coversprays and dusting with DDT are, however, in progress. Some success has been achieved, but the questions of high cost, and correct timing of applications require further research. Furthermore, there are definite indications that a higher residue of DDT than permissible will remain on fruit treated with certain DDT formulations.

The following formulae are recommended :—

Sodium fluosilicate 2 ounces, or Lead arsenate 2½ ounces, or Thiophos wettable powder (containing 15 per cent. parathion) 1 ounce, 3 lb. sugar and 4 gallons water.

Where parathion is used, regular weekly baiting is essential, because the material loses its potency when exposed to weather.

In view of the fact that parathion is extremely poisonous to human beings and animals, it has been deemed inadvisable to use it on fruit within three weeks of cropping.

**How to Apply the Bait-spray.**—Knapsack sprayers, garden syringes, bucket and stirrup pumps and even power sprayers may be used, provided that the jet is relatively coarse and "rains" on to the foliage. Correct application will insure that little or no poison bait droplets fall on the fruit itself. It is undesirable to apply the bait as a fine mist, or to drench the trees as in cover-sprays.

A quarter to half a pint of mixture is required per tree, or 10 gallons per morgen. It is important that the mixture be thoroughly agitated and the preparation and application adequately supervised.

**Winter Control.**—This treatment must be carried out by all growers of peaches, nectarines, etc., as well as apples, pears and grapes. During the months May to September all evergreen hosts such as citrus, guava and loquat, as well as hedges, ornamental trees and shrubs in the

*Extract from an article by A. C. Myburgh and W. A. K. Stubbing in *'Farming in South Africa'*, Vol. 26, No. 298, Jan. 51, pp. 7-8 and 13.

vicinity of orchards and vineyards, must be bait-sprayed at least once a month. Where serious infestation of summer fruits is experienced, more frequent treatment is necessary, especially in May and again in September. Sunny days should be chosen for the bait application.

**Control in Peaches, Nectarines, etc.**—Commence treatment as soon as trees are well covered with foliage. Treat every 3 weeks until within a month of picking. Thereafter the bait must be applied every 7 days, and this treatment continued until at least 3 weeks after the crop has been harvested.

**Control in Pears and Apples.**—Commence treatment around the beginning of January. Three to four weekly applications only are necessary up to within a month of picking, after which weekly bait-spraying is necessary. Particular attention must be given to orchards adjoining peaches, etc., and control measures must be applied in the latter even after their crops have been picked.

**Control in Grapes.**—Control measures must be carried out, as outlined above, in all fruits in orchards and gardens the origin of the fruit-flies which later infest grapes. Weekly baiting is necessary from the time when the berries of any particular variety begin to soften. Concentrate first on vineyards adjoining orchards and gardens and on areas around irrigation furrows, and apply during hot weather. Each row should be bait-sprayed in such critical spots, but every 4th row only in places further removed and where the infestation experienced is generally less severe. Different rows should be treated on each successive occasion until all rows have eventually been baited.

**Sanitation Measures :**

The conscientious application of sanitation measures in orchards, vineyards, gardens, and in the packhouse is as essential for successful control as a thorough programme of poison-baiting.

Infested fruits noticed on the trees, and all dropped fruit should be removed two or three times a week and treated in such a way as to ensure the destruction of all eggs and maggots contained therein. Daily treatment is advisable in the case of infested fruit arriving at the packhouse and infested grapes removed from the bunches at packing time. The practice of selling infested fruit to hawkers is a pernicious one, which cannot be too strongly condemned.

Suitable methods for dealing with infested fruit include—(a) Incineration, and (b) immersing the fruit in water for one week.

Neglected fruit trees in odd corners are often a serious source of infestation. All fruit trees which cannot be properly treated should be uprooted without compunction. As far as possible, steps should be taken to reduce the variety and succession of host fruits in orchards and gardens. Growers of deciduous fruits and table grapes will find that their fruit-fly problem will be greatly reduced if the various kinds of citrus fruits, guavas, loquats and others which provide breeding or sheltering places when their main crops are not available, are eliminated.

## PROBLEM OF LOW VOLUME SPRAYING MACHINERY*

It was only about 30 years ago that spraying with a mobile machine began to play an important part and only one general form of machine was used in which large volumes of spray fluid were pumped at high pressure with a reciprocating positive displacement pump to break up spray. In order to avoid frequent returns to base for refilling, the tank was made as big as the sprayer could carry and the tractor pull. The machines were in consequence, heavy, cumbersome, expensive and power-consuming. Similar machines were also used in early days for ground crop spraying. When ground crop spraying began, the machines designed for tree spraying, were modified to spray the ground, but no attempt was made until about 1938 to design efficient and economic ground sprayers.

With the advent of selective hormone weed-killers which must be used in a concentrated form, the engineers and biologists turned their attention to producing sprayers which could be tractor-mounted and needed refilling at only infrequent intervals and consequently, the low volume sprayer made its appearance.

Low volume machines are, of course, by no means perfect inasmuch as it is necessary occasionally to resort to high volume spraying with other selective weed-killers like DNOC to kill weeds resistant to hormones which tend to become prevalent when hormones are used continually. On this account, dual purpose machines have been evolved which can be converted from low to high volume by changing the nozzle.

In cereal crops, low volume spraying of selective weed-killers has largely superseded traditional methods of weed control quickly and easily on account of the following reasons :

(1) the herbicides can be used at high concentration ;

(2) the difference between a weed killing dose and a dose dangerous to the crop, is wide and there is little danger of overdosing ;

(3) the boom is placed only a foot or two above the young corn so that there is little fear of drift of spray droplets falling on susceptible crops and there is no need to use a large amount of power in achieving satisfactory coverage ;

(4) the method of spraying is ideally easy for achieving a precise deposit and avoiding the needle-like blades of young corn and hitting the broad-leaved weeds, and

(5) it is not necessary to achieve a perfectly uniform and complete cover since the spray is absorbed into the plants.

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*Extracted from "Problems of Low Volume Spraying Machinery" by S. J. Zimmer, published in *'World Crops'*, Vol. 8, No. 7, 1951.

Because of the disadvantages like high cost, need for large quantity of water and the slowness with which they cover the ground, the heavy high volume sprayers of the present day might go out of use provided the low volume spraying methods are also applicable to other crops as well. It is certain that low volume spraying, using either mist blowers or aeroplanes, cannot be as thorough as high volume spraying, but it has undoubtedly the advantages of cheapness and speed.

However, there are a few drawbacks in low volume spraying by mist blowers and aeroplanes. In aircraft spraying, all the drops land on the plant above and only the upper leaf surface receives much spray. For a wind-borne fungus infection which itself lands on top of leaves this form of deposit may be suitable. But for insects which live and multiply in the shade of the leaf, an aerial spray is less effective. An exception will occur if a systemic insecticide which is translocated by the plant, is used and also if the insecticide has a partial fumigating action, e.g. in the case of parathion where actual contact of the spray with the insect is unnecessary. An exception to this also occurs in Helicopter spraying since with violently turbulent conditions in the pressure cushions below the motor, the spray is blown under and around the leaf surfaces and distributed all over the plant. In orchard spraying with mist blowers, it is difficult to ensure that the centre and top of the tree receive as large a dose as the lower outer-most branches near the sprayer. The same defect occurs with high volume automatic sprayers. Since the top centre of the tree is the favourite insect dwelling place, often aptly called the ' pest nest ', future work must be directed to the removal of this defect and to ensure that deposit density or the dose is sensibly constant as the general defect of all the cheaper methods of spraying however is that it has not yet been possible to get uniform distribution at all points of the band sprayed in one traverse.

Besides, all low volume spraying depends to a considerable extent to weather conditions and particularly on the prevalent wind. Very small drops must be used to achieve an adequate dispersion, drops as small as 100 microns in diameter (i.e. approximately four thousandth of an inch) are about an average size for low volume sprays. These are very nearly permanently air-borne and move with the least drought. Small droplets are at the mercy of the wind and the power of the wind is very frequently underestimated. Thus, a fresh benzene blowing through an orchard has an energy content of several horse power. Accordingly it is now common practice in America to spray at dawn and dusk when air movement is least in order to take advantage of weather conditions most suitable for low volume spraying.

## PRELIMINARY FIELD TRIALS WITH INSECTICIDES.

### (i) Torch Brand Kitkari insecticides.

Kitkari BP505 : 5 per cent. BHC contained in Kitkari BP505 was effectively tried against mustard sawfly, *Athalia proxima* infesting radish ; painted bug, *Bagrada cruciferarum* infesting cauliflower, cabbage and radish ; and *Euproctis* sp., infesting brinjal, during October-November. Trials conducted with it during the last week of August against lace wing bug, *Urentuis echinus* and aphids, *Aphis gossypii* gave a kill of 70 per cent and 75 per cent respectively. The kill obtained in case of jassid, *Empoasca devastans* infesting potato in November was on average 60 per cent. This insecticide was also tried against *Dacus ciliatus* and *D. cucurbitae* infesting bitter gourd, snake gourd, *Coccinia indica* during July and August. It was tried with the object that BHC might either repel the adult flies or kill them when they come in contact with them on the dusted crop. The insecticide was observed to be ineffective in checking the damage of the fruit flies. It, however, proved slightly phytotoxic to the foliage of *Coccinia indica* and water melons.

**Kitkari AP5045.**—This sample contained 5 per cent. DDT wettable powder and was tried in concentration of 0.2 per cent with the following results.

The damage of nocturnal beetles (*Adoretus* spp.) on the foliage of guava and falsa (*Grewia asiatica*) was greatly checked after spraying the fruit trees with 0.2 per cent DDT in August. The brinjal crop was sprayed with 0.2 per cent DDT against the infestation of lace wing bug, *Urentius echinus* ; jassids, *Empoasca devastans* ; and white flies, *Bemisia tabaci* and the kill obtained was respectively about 95, 66 and 55 per cent.

### (ii) Selective systemic insecticides.

This Directorate has tried two samples of non-radio active systemic insecticides containing 66 per cent bis (bis dimethyl amino phosphorous) anhydride in the proprietary products named ' Pestox 3 ' and ' Tetrox ' supplied by the Pest Control Ltd., Cambridge and the Imperial Chemical Industries. The insecticides are also commonly called Octa methyl pyrophosphoramid (OMPA) or Schradan in U.S.A.

*Pestox* 3 :

Pestox 3 was tried in concentration of 0.05 per cent against the mango hoppers (*Idiocerus* spp.) infesting mango and citrus psylla (*Diaphorina citri*) infesting citrus in the month of May. No appreciable reduction of the pests referred above was observed possibly due to low dosage and poor translocation. The trial of the insecticide in the above concentration was repeated against citrus psylla and falsa psylla infesting citrus and *falsa* plantations respectively in the middle of July without much to the credit of the insecticide. The concentration was, however, more than 50 per cent effective when tried on young crop of

lady's finger against red mites (*Paratetranychus indicus*) about the end of May. The residual effect could not be observed owing to subsequent heavy downpour of rain which washed off the mites. The effect of the insecticide was evident because of its better translocation in the young foliage of the crop. After the spraying the plants developed unusually large sized leaves and general stand of the crop was better.

As the result of the trials of the insecticide in dosage of 0.05 per cent was not encouraging further trials were conducted with higher concentrations.

Pestox 3 in concentration of 0.1 per cent was tried against cotton jassid (*Empoasca devastans*) infesting cotton crop in August. There was no quick knockdown effect of the insecticide but 90 per cent mortality of the pest was observed within 24 hours. A further drop in population by 5 per cent was observed after a week. After about ten days the young nymphs were found on cotton crop unaffected and thus it was inferred that the residual effect of the insecticide under the conditions prevailing at Delhi, did not last for more than ten days.

*Tetrox* :

The trials with 'Tetrox' were conducted at the Central Vegetable Breeding Station, Kulu (Punjab) against cabbage aphis (*Brevicoryne brassicae*) infesting cabbage. The insecticide was used in three concentrations viz. 0.1, 0.25 and 0.5 per cent. The effect of the insecticide was evident after 48 hours and continued for about 12 days. The following table gives the detailed observations :—

| Date | Crop | Pest | Concentration used in % | Percentage of mortality |
|---|---|---|---|---|
| 24-10-51 | Cabbage | *Brevicoryne brassicae* | 0·1<br>0·25<br>0·5 | The crop was sprayed on this date. |
| 26-10-51 | ,, | ,, | 0·1<br>0·25<br>0·5 | 20<br>50<br>75 |
| 28-10-51 | ,, | ,, | 0·1<br>0·25<br>0·5 | 70—75<br>90<br>100 |

It was observed that translocation of the insecticide was slow in the plants with tough and old leaves and in consequence the effect was also slow. The above results revealed that a complete mortality of the pest was obtained four days after application of 0.5 per cent strength and about 90 per cent mortality of the pest was obtained within a week in case of 0.25 per cent strength. This concentration is likely to prove more economical and its large scale application would leave enough margin for the predators and parasites to subsist on the aphids which have not been killed and continue their race.

## TOXIC CHEMICALS IN AGRICULTURE*

### Mode of action and dangers to man, of DNC and the Organophosphorus Compounds.

Many of the effects of DNC are due to its general stimulant action on the metabolism of mammalian tissues. Death is usually attributed to hyperpyrexia (an excessively high body temperature), but the real cause probably lies in very subtle disturbances in cellular metabolism. The acute toxic dose for man is thought to be about 1-2 g. By comparison with nicotine, it is much less toxic, since nicotine has a lethal dose for man of 40 mg.

The lethal dose of DNC is in fact, so large that human fatalities following contact on a single occasion are unknown. The problem is rather one of chronic toxicity following frequent or prolonged exposure. Under spraying conditions, when exposure may be relatively continuous, DNC is likely to act in a cumulative manner. When absorbed, it is destroyed by the body, but when absorption is continuous it may accumulate faster than it can be destroyed and thus a fatal concentration may be built up.

Several routes of absorption are possible under spraying conditions. Skin absorption, the inhalation of spray drift, the ingestion of contaminated saliva and of contaminated food and drinking water probably all contribute to the accumulation of DNC in the body, although it is not possible to assess the relative contribution of each route to the final toxic level. The danger of poisoning through absorption by the skin must be emphasized. Hot weather can raise the death rate of animals exposed to DNC and is thought to increase the danger of poisoning in man.

Three compounds in the organo-phosphorus group are of immediate importance namely, parathion, TEPP and schradam. Parathion is representative of the group ; it can be absorbed through the skin and by inhalation and ingestion. Death can occur as a result of a single exposure ; but chronic toxicity is the main problem. Repeated absorption of parathion may result in cumulative poisoning. Parathion appears to inactivate the enzyme cholinesterase. This enzyme is intimately concerned in the transmission of impulses between the nerves and muscles. When the cholinesterase level falls below 50 per cent of normal, symptoms are to be expected. Cholinesterase is present at the motor nerve endings, and inactivation of the enzyme results in muscular twitchings and weakness that may develop into paralysis. Death may follow from paralysis of the respiratory muscles. That part of the nervous system which controls automatic body processes is also affected. Successive small doses of parathion may progressively lower the cholinesterase level without producing symptoms, but may render the individual increasingly susceptible to further doses. Owing to the slow restoration of cholinesterase to its normal level, this susceptibility will persist for a long time, may be for some weeks.

*Extract from "Toxic Chemicals in Agriculture", Min. Agric. & Fisheries, London, pp. 3-5, 1951.

The lethal dose of parathion is thought to be about 0.2-1.0 g. for a man of average weight. This is between 1/5 and 1/25 of the toxicity of nicotine.

TEPP differs from parathion in having a lethal dose level of about 0.35 mg./kg. Despite its greater acute toxicity for animals it appears in practice to be less dangerous because it decomposes rapidly. In spraying contact with the spray drift containing TEPP produces blurring of vision as an early symptom, so that work has to be given up before more serious symptoms develop.

Schradan has a lethal dose level of about 8 mg./kg. It is almost completely stable in the ordinary conditions of use, and it acts as a systemic insecticide. When schradan is introduced into animals it is converted into an active cholinesterase inhibitor.

Profuse sweating and extreme thirst are striking features of DNC poisoning and are accompanied by anxiety, restlessness, insomnia and difficulty in breathing. The progress of symptoms from those which might be attributed to fatigue and hot weather to serious illness and death has been rapid and dramatic in the fatal cases.

## RECOMMENDATIONS

### (i) Protective Clothing.

The complete list of protective clothing should comprise : overall of white cotton or similar material, fastening at the neck and wrists ; a white cloth hood to cover the head and the back and sides of the neck ; rubber coat ; rubber apron ; rubber gloves ; rubber boots ; eye-shield ; respirator, and sou'wester.

**Mixing.**—The following items should be worn on the various operations : Overall ; rubber boots ; rubber apron ; rubber gloves. When mixing takes place indoors, a respirator should also be worn ; and eye-shield should be sufficient when the mixing is done out of doors

**Spraying.**—Crops : Overall ; hood; eye-shield; rubber boots; rubber gloves. Trees : Same as for crops, except that a sou'wester and rubber coat should be worn in place of overall and hood.

**Greenhouses.**—If the manufacturer's instructions regarding the use of smoke generators in greenhouses are followed, and the operator avoids inhaling the fumes during ignition and adequately ventilates the greenhouse before re-entering, he need not wear protective clothing, but he should carry a respirator at the ready position. If, however, the operator should have to enter a greenhouse while poisonous smoke or spray is present, he should wear overall, hood, rubber boots, rubber gloves, and a respirator of the full-face type. Workers applying sprays in greenhouses should be similarly equipped.

**Tractor Spraying.**—With air-conditioned cab, the driver should wear overall and rubber boots.

Without air-conditioned cab, the driver should wear overall, hood, rubber boots rubber gloves, and an eye-shield.

The worker riding on the sprayer in order to attend to the spray nozzles should wear overall, hood, rubber coat, rubber gloves, rubber boots and an eye-shield.

A list of the protective clothing needed for each operation should be available for reference by both employer and employee.

The overall and hood should be taken off for laundering, and a new or laundered set provided, when they have become noticeably contaminated by the spray. Even if not noticeably contaminated, the overall and hood should be changed at the end of a week's work. The workers should remove all their protective clothing at the end of their spraying operations. On no account should they wear any part of it when they leave the farm at the end of the day's work.

**(ii) Tractor Cabs.**—The evidence regarding gas-proof, air-conditioned cabs was not sufficiently conclusive to enable us to make a general recommendation about the advantages of this form of protection. Where such cabs are used, we recommend, however, that their protective properties should be frequently tested. We understand that a reliable test would consist of releasing the vapour of a lachrymator (tear-gas) such as ethyl-iodo-acetate into the air intake of the charcoal filter.

**(iii) Washing Facilities.**—Soap, clean towels, and clean water should be provided near the scene of spraying operations but sufficiently removed to avoid any contamination from spray drift. Running water should be used if available. Alternatively, clearly marked separate containers should be provided for washing (a) rubber boots, gloves, etc.; (b) the face and hands.

**(iv) Working Periods.**—No worker engaged on spraying operations should work more than 10 hours a day nor more than 6 days a week. No worker should be engaged on spraying operations while he is suffering from a minor complaint such as a cold, bronchitis, or stomach upset.

**(v) Supervision.**—Every person employing workers on the agricultural use of dinitro or organophosphorus compounds should be required to make proper arrangements for their supervision and instruction.

(vi) **Meals** : All workers engaged on spraying operations should be forbidden to eat or drink in the spraying area, or to smoke while on their work.

**(vii) De-contamination of machinery and equipment** : Spraying machines, hoses and spray-lances should be washed with water before repairs are made, and at the end of each shift; tanks and containers should be washed thoroughly at the end of each shift.

**In no circumstances should the workers clear blocked jets by blowing out with the mouth.**

(viii) **Warning to local doctors** : The Ministry of Agriculture and Fisheries should consult the British Medical Association about the practicability of medical practitioners being circularized by the Association about the dangers and appropriate treatment.

Medical practitioners and hospitals should be warned when spraying operations are to be undertaken on farms in their vicinity.

(ix) **Manufacturers' responsibilities** :

*Labels* : The labels of containers should be required to show the words " Deadly Poison " in large, clear type, a concise statement of the dangers, and precautions to be taken, antidotes where known, and a minimum indication of the purposes for which the product is to be used.

The labels should be of a permanent kind. Manufacturer's instructions about the control of pests and weeds should be given separately from the main label *e.g.* in the form of wrapping leaflet.

*Colouring of materials* : Organo-phosphorus formulations should be coloured, preferably with one distinctive colour, during manufacture.

*Notification of new preparations* : In view of the need to inquire into such precautionary measures as might prove necessary, the Agricultural Departments should satisfy themselves that their arrangements with industry are adequate to obtain prior information about the chemical compounds which the manufacturers propose to market as insecticides and weedkillers.

(x) **Introduction** : The Agricultural Departments should institute arrangements for the thorough education of all concerned in the dangers of the chemical compounds and in the precautionary measures to be taken.

(xi) **Research** : The Medical Research Council, in co-operation with other research or investigating bodies, should be asked to carry out research into protective devices, in an effort to discover a material which will give complete protection against DNC and organo-phosphorus sprays, without interfering with the comfort and working capacity of the wearer. The Ministry of Supply should be asked to promote research with the object of producing a lightweight respirator which will give complete protection against inhalation of DNC and Parathion dusts, fumes and smokes. The Agricultural Research Council should be asked to undertake experiments to discover insecticides and weedkillers which are fully effective in their agricultural purposes without being toxic to man.

**54.** We advise that certain of our recommendations should become the subject of statutory regulations. We consider that all the protective measures recommended in Para 53(i), (iii), (vi), (v) and Para 53 (ix) as to labelling, should be given legal effect, and that the Agricultural Departments should have power, where appropriate, to enforce them by inspection. We also consider that the Departments should have power both to limit the duration of exposure of operatives to risk of contamination, on the lines of the recommendation in Para 53(iv) and to schedule chemical compounds for the purpose of the legislation.

55. While the institution of an elaborate system of inspection would not be practicable, we feel that there should be a power of enforcement and that test checks should be made from time to time to ensure that the protective clothing is provided and is worn, that washing facilities are provided and are used, and that meals are not consumed on the scene of spraying operations. Some of the statutory measures we have recommended, would impose legal obligations on the worker as well as on the employer.

56. We recommend that adequate arrangements should be made for the protection of the workers who will be engaged in the Agricultural use of DNC and organo-phosphorus compounds during the spraying season which will commence in the early spring of this year. We feel sure that the necessary arrangements could be made through the collaboration of all the parties concerned, even though it may be impracticable for our proposals to be fully examined, and, if accepted, for legislation to be put forward, in time.

57. In the course of our inquiry, we have found that the public may be exposed to some risk to health arising from the Agricultural use of dinitro and organo-phosphorus compounds and we have been asked by the Ministers of Agriculture and Fisheries, Food and Health, and the Secretary of State for Scotland, to investigate this risk. The chief danger lies in the chronic effects which result from frequent exposure to these chemicals, and this greatly reduces the hazard to the general public since normally they are not so exposed. There are, however, certain precautions which should obviously be taken in the public interest. We recommend these in advance of any further advice which we may put forward at the end of the second part of our inquiry, namely;

(xii) Spraying operations should be suspended in windy weather particularly on land adjacent to public roads or footpaths.

(xiii) Warning notices should be placed on gates giving access to fields that are being, or have recently been sprayed.

(xiv) Surplus spraying material should be safely disposed of, to avoid any possible contamination of ponds or stream.

(xv) Farm animals should be kept away from spraying operations and from fields that have recently been sprayed.

(xvi) To minimize adverse effects on pollination, beekeepers should be warned before spraying operations are started on neighbouring farms.

58. There is no legal prohibition on the sale of dinitro and organo-phosphorus formulations to the general public and we consider that in view of the dangers associated with the ignorant or inexperienced use of these chemicals, the sale to the public of formulations containing them should be brought under statutory control. We think that such control would be in the interest of the trade as well as of the public. We, therefore, recommend;

(xvii) That the retail sale of dinitro and organo-phosphorus compounds, other than winter washes made up in small concentrations should be restricted to chemists. This would not prevent farmers who wish to buy their supplies by retail, from doing so.

## NOTES & NEWS

### CMU, a new chemical herbicide*

This new weed and grass killer is non-inflammable and non-corrosive. This year, it is being recommended for industrial uses only—around railroad track areas and trestle sites, arsenals, lumberyards, gasoline storage areas, and other locations where total removal of plant growth is desirable to eliminate fire hazards. It is not currently recommended for use on crop-land. CMU is formulated as a wettable powder containing 80 per cent 3-(*p*-chlorophenyl)-1, 1-dimethylurea.

This new product of research in Du Pont laboratories has been found to be particularly effective in places where it is desirable to destroy all vegetation.

So far not enough is known about the new chemical's effect on the soil for Du Pont to recommend its use in crop areas, but eventually it may be expected to find a useful place in agriculture.

### A new disease of papaya†

The Mycologist, Assam has reported the occurrence of a new disease of papaya in his State, which he believes to be due to a virus and different from the 'leaf-curl' disease. It is characterized by yellowing and mottling of the leaves and is accompanied with profuse flow of milk from the fruits.

### Seed-treatment‡

Seed-treatment is useful for seed-borne diseases only, and, since it has been found that some of these diseases are carried over within the seed as well as on the outside, heat treatment is the best control.

Fermentation of the pulp for a period not longer than three days gives good control of any 'carry over' which might occur from infected mucilage adhering to the seeds, but it is advisable to further treat the seeds by soaking them for 25 minutes in hot water maintained at a temperature of 122°F.

In the absence of a thermostatically controlled tank made for the purpose, a round 4-gallon tin is suitable if completely covered with many thicknesses of newspaper or with straw to retain the heat.

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*Extract from '*Agricultural News Letter*' of E.I.Du Pont De Nemours & Co. (Inc.), U.S.A., Vol. 20, No. 2, page 19 (1952).

†Abstract from the Quarterly report on Plant Diseases and Insect pests in Assam (2nd Quarter, 1952).

‡Extract from '*Agriculture News Letter*' Release No. AGN|362, p. 1, Australian Government Trade Information Service.

The vessel should be about three parts filled with hot water. Cold water is then added until the desired temperature is reached. The seeds are immersed, tied in muslin or other suitable material, and the procedure checked carefully with a clock and thermometer. After treatment, the seed is dried on calico or similar clean material.

### Pest and Disease control*

Pest and disease control is carried out in the Goulburn Valley of Australia by the use of Combination dusts containing DDT, benzene hexachloride, copper compounds, and sulphur. The idea that a healthy crop need not be dusted, is a mistaken one, and to wait until pests or diseases show their appearance before dusting, is like ' bolting the door when the horse is gone ', and any effort at this stage is half wasted. Dusting every 12 to 14 days preferably in the early morning is essential for continuous healthy growth. Spraying is done in isolated places, but if the equipment is available, is to be preferred to dusting.

### Spotted-wilt of potato†

' Spotted-wilt ' of potato appeared in an epidemic form in Eastern Australia in 1945-46. It is a virus disease and produces lesions similar to those caused by *Alternaria solani*. It can however be differentiated from the latter by the presence of a green island in the necrotic spot. Moreover, the spots in spotted-wilt are on the younger leaves at the top of the plant, the lower leaves being symptomless. In early blight the reverse is true. Shortly after necrotic spotting is noted on the leaves, dark streaks appear in the terminal portion of the affected stem; the necrosis increases in severity and the growing tip dies, at the same time the spotted leaves shrivel and hand down. In those plants that survive the initial necrosis, the disease enters a secondary phase. The plants get dwarfed and present a bunchy appearance. The tubers may get small, distorted and show terminal pitting and cracking. The disease is transmitted by planting diseased tubers and by the insect vector *Thrips tabaci*. Varieties such as Up to Date, Bismark, Sebage, and Carman appeared to be very susceptible. The virus of spotted-wilt is world-wide in distribution, but it has never been reported as causing trouble in potatoes except in Eastern Australia. This probably is due to the fact that,

(1) highly susceptible varieties of potato are grown in Eastern Australia;

(2) they are being planted at a time when their preflowering susceptible period, coincides with the time of maximum breeding and activity of the thrips vector ;

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*Extract from *'Agriculture News Letter'* Release No. AGN|362, p. 3, Australian Government Trade Information Service.

†Norris, D. O.—Spotted-wilt of potato I and II, *'Australian Journal of Agriculture Research'*, Vol. II, No. 3, 1951.

(3) Seasonal conditions allow intensive thrips breeding in the spring.

Probably in other parts of the world, a suitable combination of these factors has not occurred.

### Chemical Control of Lantana*

Hormone weedkillers are now found to be preferable to arsenic as a means of killing the roots of lantana by swabbing cut-off butts or spraying regrowth after brushing, as they are non-poisonous to animals and humans, non-corrosive and do not kill grasses.

The use of ' Methoxone ' or sodium salts of 2,4-D, results in good kills if old plants are brushed and sprayed when there is abundant and vigorous regrowth, as spraying very young shoots results in little downward movement of the hormone so that the roots may not be killed.

2,4,5-T formulations (either alone or in combination with 2,4-D) are more effective than 2,4-D alone, particularly on large uncut bushes. But as it is not possible to spray effectively large areas of dense lantana, and as 2,4,5-T is dearer than ' Methoxone ' and salts of 2,4-D, the use of the latter two hormones is probably more economical.

The hormones should be applied to lantana in fine weather and preferably by means of power sprayers.

### Control of Strawberry ' red-stele ' by chemotherapy†

E. M. Stoddard of the Department of Plant Pathology, New Haven, Connecticut, reports that the ' red-stele ' disease of strawberry, caused by *Phytophthora fragariae,* can be controlled by soil applications of disodium ethylene bisdithio-carbamate (Dithane D-14). This is based on experiments made in the greenhouse, as well as in the field.

In field experiment, the chemical (1.5 parts of Dithane D-14 : 100 parts of water) was injected, at the rate of approximately 2,000 gallons per acre, under pressure, into the soil in an infected area. The entire infected area as well as a band ten feet wide on its perimeter was treated, when the plants started to blossom. The spread of the disease was immediately checked, while no injury resulted to the healthy plants in the adjacent treated band. On a second treatment, after picking, no spread of the disease occurred in the same or the following year and healthy plants set in the treated infested area remained healthy.

Dithane D-14, probably acted as a therapeutant and soil sterilant in the field experiment.

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*Extract from article by B. Easterbrook in ' *Queensland Agric. Journal*', Vol. 71, part 1, July 1950.

†Extract from a note received from Dr. E. M. Stoddard, Plant Pathologist, Connecticut Agricultural Experiment Station, New Haven, Connecticut, U.S.A.

## Methyl Bromide for Weed Control in Nurseries*

Methyl bromide can be used as a non-selective weed killer in nurseries without any harmful residual effects in the soil and also for the control of damping-off organisms and pests, namely, white grubs and nematodes.

Weed-seed can be destroyed by applying methyl bromide at the rate of 1 lb. per 100 sq. feet of soil surface. The soil to be treated is brought to a good tilth and the beds formed. For most effective results the soil should have sufficient moisture for good working conditions and a temperature above 50°F. The beds are covered with tarpaulin 4 to 6 inches above the soil surface and supported by ridge boards at the sides. The methyl bromide is released under considerable pressure from the applicator through plastic tube outlets. The covering remains in place for 24 hours after the fumigant is introduced to permit the gas to permeate the soil. The tarpaulin is then removed and the soil left to aerate for 48 hours, after which the bed is ready for either seeding or transplanting.

The stock produced in treated soil has given better stands to justify some reduction in seeding rates and have resulted in planting stock of much better quality and vigour.

Methyl bromide is, however, a highly toxic gas and the instructions of the manufacturers must be carefully followed while using it.

## Rotproofed Fruit†

A film less than one-thousandth of an inch thick, sprayed on to fruit before transport or storage, is claimed by D. W. Bingham & Co., Pty., Ltd., (Melbourne) to prevent rotting while enabling the fruit to "breathe". Fruit so protected is said not to need cold storage. The fungicidal agent is cetyl trimethyl ammonium bromide and the carrier carboxymethyl-cellulose, but other quaternary ammonium compounds with other water-soluble cellulose derivatives are also being tested. The film takes three hours to dry and gives the fruit a slightly polished appearance. Although the gel itself has a bitter taste it does not, in film form, flavour the fruit; in any case, the film can be easily washed off.

A considerable amount of work on the skin coating of apples has been done in the United Kingdom by the Ditton Laboratory of the DSIR, and this work is continuing. It is established that the coatings check water loss and that incorporation in the sprays of 0.025 per cent phenyl mercuric chloride or 1.1 per cent iodine has a striking effect in preventing rot. (*'Food Engineering'*, August, 1951, p. 187).

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*Extract from an article entitled 'Soil Reborn', by J. C. Koptike, *'Down to Earth'*, Vol. VII, No. 3, pp. 2-5, 1951.

†Extract from Science News Letter 50 issued by the Scientific Adviser to the High Commissioner, India House, London.

## Problems of Weed Control*

Dr. L. M. Stahler, Senior Agronomist in the United States Department of Agriculture at Fernhurst, while speaking on Chemical Weed Control in North America, said that weedicides of the substituted Chloro-phenoxyacetic acid type of which 2,4-D and Methoxone are examples, are very effective against a wide variety of broad-leaved annual and perennial plants, but they leave grasses unaffected.

It has been found in certain areas that consistent and persistent use of 2,4-D has already changed the weed population from an annual broad leaved complex to an annual grass complex. Consequently, researches are being carried out to discover weedicides which are effective against grasses. So far, the successful chemical discovered in this regard, is trichloroacetic acid, TCA which has already won wide acceptance for the control of grasses in U.S.A. It is said to be highly selective in its action and has been successfully used in controlling certain grasses in such crops as sugar-beet, flax and certain legumes. Its advent is regarded as real promise in weed control.

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*Extracted from the Editorial Comment of '*World Crops*', Vol. 3, No. 9, dated September, 1951.

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